ISSN (print) 0093-4666 © 2012. Mycotaxon, Ltd. ISSN (online) 2154-8889

MYCOTAXON

http://dx.doi.org/10.5248/120.471

Volume 120, pp. 471–475 *April–June 2012*

Tuber microsphaerosporum and *Paradoxa sinensis* spp. nov.

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Abstract — Two new truffle species from China are described and illustrated. *Tuber microsphaerosporum* is recognized by its small ascospores and 1–7-spored asci. *Paradoxa sinensis* is separated from the European *P. monospora* by its pale color and larger ascospores.

Key words — *Ascomycota*, mushroom market, *Tuberaceae*

Introduction

Knowledge about truffles in China has become richer since the first publication on *Tuber* in China by Liu (Liu 1985). Of the many species found, a high percentage has proved endemic (Wang 1988; Chen et al. 2005, 2007; Fan et al. 2011, 2012a, b). Recently we obtained two truffle-like fungi from a mushroom market in Kunming that we recognized as two new truffle species, a *Tuber* and a *Paradoxa*, described and illustrated here.

Materials & methods

The fresh fruiting bodies were collected from a local mushroom market in Kunming, China. Macro- and microscopic characters were described from fresh specimens. Sections were cut by razor-blade and mounted in 3% KOH for observation or stained in Melzer's reagent, rinsed, and mounted in polyvinyl lactic glycerol for permanent slides for archiving to be kept with dried specimens. For scanning electron microscopy (SEM), ascospores were scraped from the dried gleba onto doubled-sided tape, which was mounted directly on an SEM stub, coated with gold-palladium, and examined and photographed with a Hitachi S-4800 SEM. The specimens are deposited in BJTC (Herbarium Biology Department, Capital Normal University).

Taxonomy

Tuber microsphaerosporum L. Fan & Yu Li, **sp. nov.** Fig. 1

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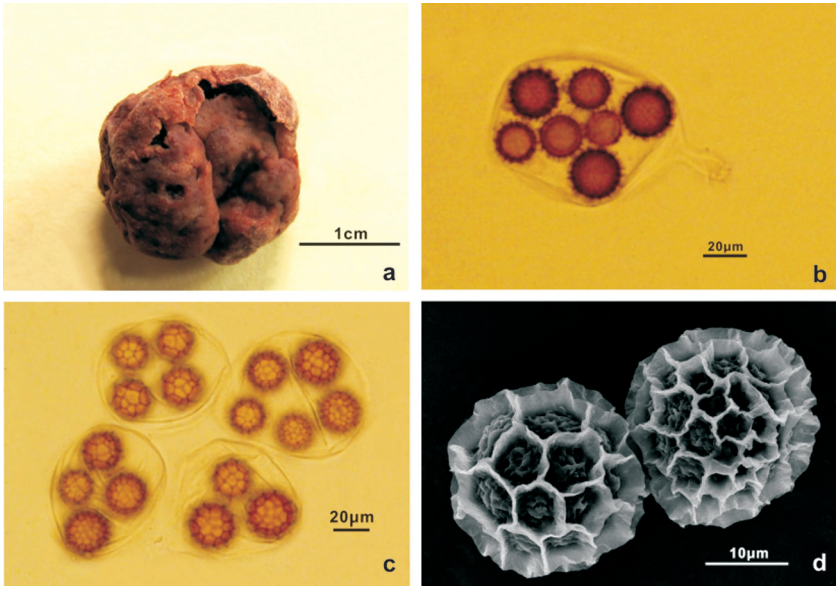

Fig. 1. *Tuber microsphaerosporum* (BJTC FAN152, holotype)
a. Ascoma. b–c. Asci and ascospores observed under light microscope.
d. Ascospores observed under SEM.

Differs from other *Tuber* species with globose ascospores by its smaller ascospores, up to 7 per ascus.

Type: China. Yunnan Province, Kunming, from a mushroom market. 20 Dec. 2010, Jin-Zhong Cao 115 (**Holotype**, BJTC FAN152).

Etymology: *microsphaerosporum* (Lat.), referring to the small globose ascospores.

Ascoma 2 cm in diam., subglobose, soft or slightly firm, solid, surface smooth, poorly pubescent to nearly glabrous, yellowish white to light yellow-brown at maturity. Odor slight, not pungent. Peridium 250–350 μm thick, two layers; outer layer 100–150 μm thick, pseudoparenchymatous, composed of subangular or subglobose cells mostly 12.5–30 μm in diam., with thin or slightly thickened walls, pale yellowish, intermixed with larger swollen cells of 70–80 × 40–50 μm with thickened walls 2.5–3 μm in diam.; inner layer 150–200 μm thick, composed of intricately interwoven hyphae, thin-walled, branching, hyaline, septate, 3–5 μm in diam. The outermost cells giving rise a few hyphae-like hairs, the hairs 20–50 × 2.5–3 μm, septate, thin-walled, light brown. Gleba light brown at maturity, marbled with large, rarely branching and white veins continuous with inner peridium. Asci globose, subglobose or broadly ellipsoid, hyaline, thin-walled, 67.5–105 × 60–70 μm, mostly sessile, sometimes with a short stalk, 1–7-spored, mostly 3–6-spored. Ascospores

globose, brown at maturity, 17.5–27.5 µm in 2–7-spored asci and 32.5–37.5 µm in 1-spored asci excluding ornamentation; ornamentation reticulate, meshes regular or irregular, 3–6 sided, 2.5–3 µm tall, the meshes generally 3–8 across the spore width.

Comments — *Tuber microsphaerosporum* differs from the other *Tuber* species with globose ascospores mainly by its smaller ascospores and the asci containing 1–7 ascospores; moreover, its peridium structure with large swollen cells is also diagnostic for this new species.

The North American *Tuber californicum* Harkn. and *T. sphaerosporum* Gilkey and European *T. oligospermum* (Tul. & C. Tul.) Trappe and *T. borchii* var. *sphaerosperma* Malençon also produce perfectly globose ascospores, but all also produce 1–4- or 1–3-spored asci. *Tuber sphaerosporum* is further distinguished by large reticulum meshes numbering 3–4 across the spore diameter while *T. californicum* has a dark-colored mature gleba and *T. oligospermum* has a one-layer peridium.

Although we found no 8-spored asci in our holotype, 7-spored asci are not uncommon; it is possible that 8-spored asci may occur in the new species.

Paradoxa sinensis L. Fan & J.Z. Cao, **sp. nov.** Fig. 2

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Differs from *Paradoxa monospora* by its yellowish to yellow-brown ascomata and larger ascospores.

Type: China. Yunnan Province, Kunming, from the local mushroom market. 20 Dec. 2010, Jin-Zhong Cao 113 (**Holotype,** BJTC FAN150).

Etymology: *sinensis* (Lat.), referring to the presumed host country.

Ascoma 2.5 cm in diam., subglobose, firm, solid, surface smooth, glabrous, yellowish to yellow-brown at maturity. Odor slight, not pungent. Peridium 200–250 µm thick, one layer, prosenchymatous, composed of intricately

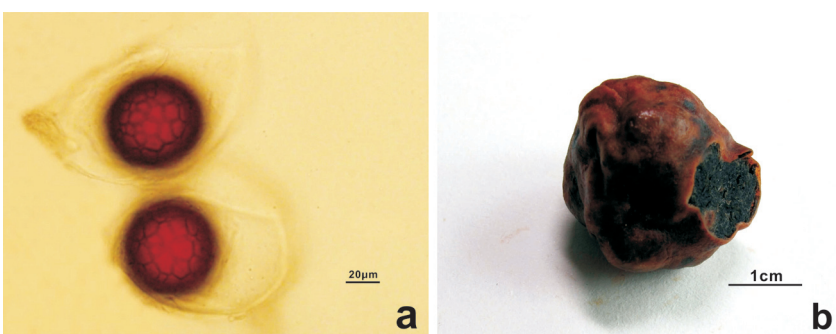

Fig. 2. *Paradoxa sinensis* (BJTC FAN150, holotype)
a. Asci and ascospores observed under light microscope. b. Ascoma.

interwoven hyphae, branching, septate, the hyphae are light yellow-brown, slightly thick-walled and 5–7.5(–10) μm broad towards the outer side of peridium, and hyaline, thin-walled and 5–7.5 μm broad towards the inner side. Gleba blackish at maturity, marbled with large, rarely branching and greyish or grey-brown veins continuous with the peridium. Asci 1-spored, rarely 2-spored, globose or subglobose for 1-spored and long-ellipsoid for 2-spored, 77.5–92.5 × 80–85 μm for 1-spored and 120 × 80 μm for 2-spored, hyaline, thick-walled, 5–7.5 μm thick, sessile or with a short tail. Ascospores globose, red-brown to dark red-brown at maturity, (55–)62.5–72.5 μm in diam. excluding ornamentation, ornamentation reticulate, irregular, meshes varying greatly in shape and size, 5–20 μm in diam., 1 μm high, averagely 6–10 across the spore width.

Comments — *Paradoxa sinensis* closely resembles the European *P. monospora* Mattir., but Ceruti (1960) describes the ascomata of *P. monospora* as black brown and the ascospores as somewhat smaller (50–60μm in diam.). The third *Paradoxa* species, *P. gigantospora* (Y. Wang & Z.P. Li) Y. Wang (Wang & Hu 2008), was originally described from China by Wang & Li (1991, as *Tuber gigantosporum*) and is diagnosed by its large elliptic ascospores (≤100 μm).

Paradoxa, originally described from Italy in 1935, was monotypic until Wang & Hu (2008) transferred *T. gigantospora* to it. *Paradoxa sinensis* represents the third species in the genus, which differs from *Tuber* mainly by its single-spored asci. Vizzini (2008), who treated *Paradoxa* as a synonym of *Tuber,* transferred *P. monospora* to *Tuber* as *T. monosporum*. Kinoshita et al. (2011) seemingly accepted this classification when they listed *Paradoxa gigantospora* as a synonym of *Tuber gigantosporum*. However, in all three *Paradoxa* species, the dominant character of one larger ascospore per ascus is always connected with peculiar reticulum on the spore surface, which is highly irregular and greatly lower, suggesting a taxonomic difference between *Paradoxa* and most typical *Tuber* species. More research is needed to elucidate whether the two genera are independent or conspecific. We prefer to treat *Paradoxa* and *Tuber* as independent genera for the time being.

Acknowledgments

We are grateful to Prof. Zhu-Liang Yang (Kunming Institute of Botany, Chinese Academy of Sciences) and Prof. Anthony Whalley (School of Pharmacy and Biotechnology, Liverpool John Moores University) for reviewing the manuscript. The study was supported by the National Natural Science Foundation of China (No. 30770005, 30870008) and the Beijing Natural Science Foundation (No. 5072006).

Literature cited

Ceruti A. 1960. *Elaphomycetales* et *Tuberales*. 1–48, in: J Bresadola. Iconographia Mycologica. 28, suppl. 2.

Chen J, Liu PG. 2007. *Tuber latisporum* sp. nov. and related taxa, based on morphology and DNA sequence data. Mycologia 99: 475–481. http://dx.doi: 10.3852/mycologia.99.3.475

Chen J, Liu PG, Wang Y. 2005. *Tuber umbilicatum*, a new species from China, with a key to the spinose-reticulate spored *Tuber* species. Mycotaxon 94: 1–6.

Fan L, Cao JZ, Liu YY, Li Y. 2011. Two new species of the genus *Tuber* from China. Mycotaxon 116: 349–354. http://dx.doi: 10.5248/116.349

Fan L, Hou CL, Cao JZ. 2012a ["2011"]. *Tuber sinoalbidum* and *T. polyspermum* — new species from China. Mycotaxon 118: 403–410. http://dx.doi.org/10.5248/118.403

Fan L, Cao JZ, Zheng ZH, Li Y. 2012b. *Tuber* in China: *T. microspermum* and *T. microspiculatum* spp. nov. Mycotaxon 119: xxx–xxx. http://dx.doi.org/10.5248/119.xxx

Kinoshita A, Sasaki H, Nara K. 2011. Phylogeny and diversity of Japanese truffles (*Tuber* spp.) inferred from sequences of four nuclear loci. Mycologia 103: 779–794. http://dx.doi.org/10.3852/10-138

Liu B. 1985. New species and new records of hypogeous fungi from China (I). Acta Mycologica Sinica 4(2): 84–89.

Vizzini A. 2008. Novitates: *Tubariaceae* fam. nov. Rivista di Micologia 51: 174.

Wang Y. 1988. First report of study on *Tuber* species from China. Atti del II Congresso Internazionale sul Tartufo, Spoleto, Nov. 24–27: 45–50.

Wang Y, Hu HT. 2008. *Paradoxa gigantospora* comb. nov. from China. Mycotaxon 106: 199–202.